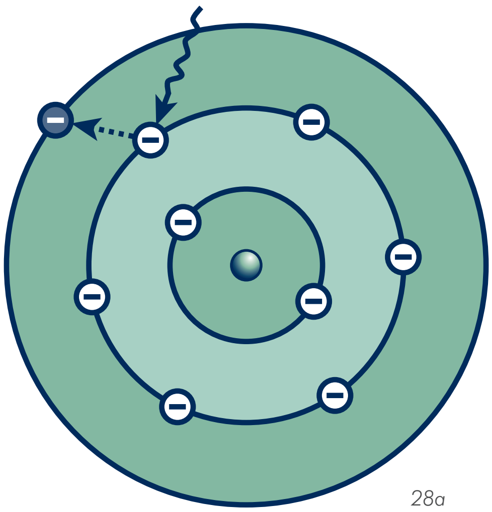
LUMINESCENCE UNDER ULTRAVIOLET LIGHT

Many gemstones, imitations or syntheses fluoresce under the light of ultraviolet lamps. UV lamps usually emit long-wave UV light (366 nm wavelength) and short-wave UV light (254 nm wavelength). Individual characteristic colours or colour changes at different wavelengths allow stones to be distinguished from one another.

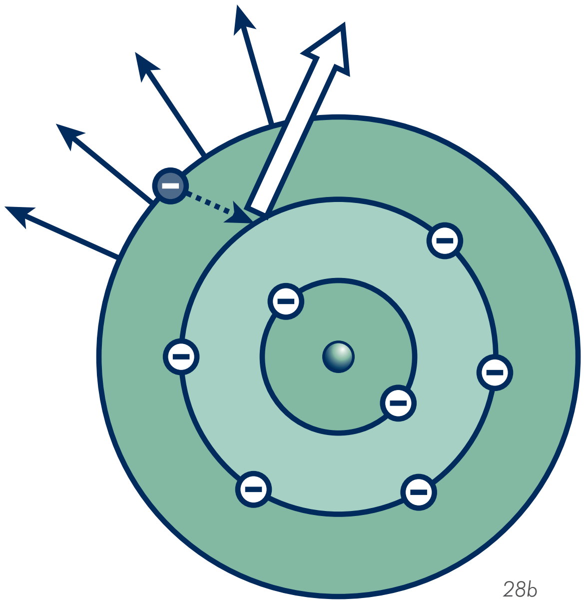
A large number of gemstones, cut or rough, can be inspected simultaneously with irradiation by an UV lamp. Occasionally the UV behaviour of the stones under irradiation with the two different wavelengths is so characteristic that the UV lamp can also be used to directly determine stones. This procedure, however, requires experience.

FUNCTIONALITY

It is best to place the stones to be examined on a black substrate and view them in complete darkness under UV light. When doing so, it is essential to wear UV protective goggles, since the high-energy UV light can damage the eyes.
If minerals - in our case gemstones - or synthetic products are irradiated with ultraviolet light, different reactions can occur. Some samples do not react to UV radiation at all. In contrast, other samples exhibit a varying degree of glow in different colours in the dark.
An afterglow is sometimes visible when the UV lamp is already switched off. The appearance of the glow under UV light is known as fluorescence, the afterglow as phosphorescence - collectively also called luminescence.
These effects are caused by certain elements or element compounds. These can occur as the main component of the substance or as trace elements in otherwise non-fluorescent materials and thereby also cause luminescence. Other elements, such as iron, can weaken or suppress fluorescence effects. The relevant elements are capable of absorbing high-energy light, such as UV light, and then immediately emitting it again. During this process, electrons initially reach a higher energy level.
In the case of **fluorescence**, the electrons leave the higher energy level almost immediately. The glow only lasts for as long as the UV radiation is effective.
In the case of **phosphorescence** by contrast, the higher energy level is not immediately left again. The energy is released more slowly here. This is why the luminescence continues for a moment when there is no more radiation affecting the gemstones.



28a



28b

Fig.28: Ground state and excitation of an atom. An electron is lifted to a shell farther away from the nucleus, i.e. to a higher energy level, by absorption of a light quantum (28a). When it returns to its initial position (restoration of the ground state), energy is released as heat and fluorescent radiation (28b).

LUMINESCENCE ASSESSMENT

DISTINGUISHING SYNTHETIC SPINELS AND GEMSTONES

The use of a UV lamp is very effective for distinguishing blue synthetic spinels from aquamarine or blue topaz. It is also used to distinguish green synthetic spinels from green tourmalines or peridots. Different UV wavelengths can identify these imitations, since aquamarines, topaz, tourmaline or peridot, for example, do not exhibit any fluorescence in principle. On the other hand, synthetic spinels have striking colours and the use of different UV wavelengths causes significant colour changes - clear indications of an imitation or, as the case may be, evidence of attempted forgery, examples of which are shown in Figure 29.

Fig.29: Green and light blue synthetic spinels under artificial light (top row), long-wave (middle row) and short-wave (bottom row) UV light. In their fluorescent colour, all stones exhibit a distinctive colour change under UV light of different wavelengths.

DIFFERENTIATION OF GEMSTONES THAT CONTAIN CHROMIUM

The contents of chromium cause some red gemstones - such as ruby, alexandrite or red spinel - to exhibit red fluorescence under UV light. Other red gemstones without chromium content - such as red garnets, tourmalines or even artificial red glasses - exhibit no fluorescence. This means that they are immediately identified as a simple gemstone or imitation. Synthetic rubies are free of other trace elements due to their formation in the laboratory. They usually manifest themselves by a bright red fluorescence. This is usually reflected in colours that are much more intense than in most natural rubies.

IDENTIFICATION OF MANIPULATED, IMPREGNATED AND RECONSTRUCTED STONES

UV light is also helpful for detecting manipulation. UV light can uncover composite stones such as doublets and triplets. They are made up of different components that may react differently under UV light. UV light also often reveals the adhesive that holds them together. Impregnated stones, such as oiled emeralds or reconstructed stones like amber with plastic, may also reveal their secret under UV light.

DIAMONDS UNDER UV LIGHT

Diamonds have a characteristic appearance under long-wave UV light. This becomes very evident when several stones of a piece of jewellery are viewed at the same time, as illustrated in Figure 30 showing a necklace with colourless diamonds. A number of diamonds here show no reaction to UV light, the majority of the stones shine in different shades of light blue. Some stones can appear in yellowish or orange shades or shine in greenish shades as shown here. Only the entire appearance of a complete piece of jewellery under UV light enables a clear identification of the stones as diamonds. If different stones exhibit irregular colours or hues as shown in Figure 30, the piece of jewellery is most likely made of diamonds. If an appearance with uniform colours or hues were to be present, a piece of jewellery would probably be made of zirconia, moissanite or glass imitations or of synthetic diamonds.

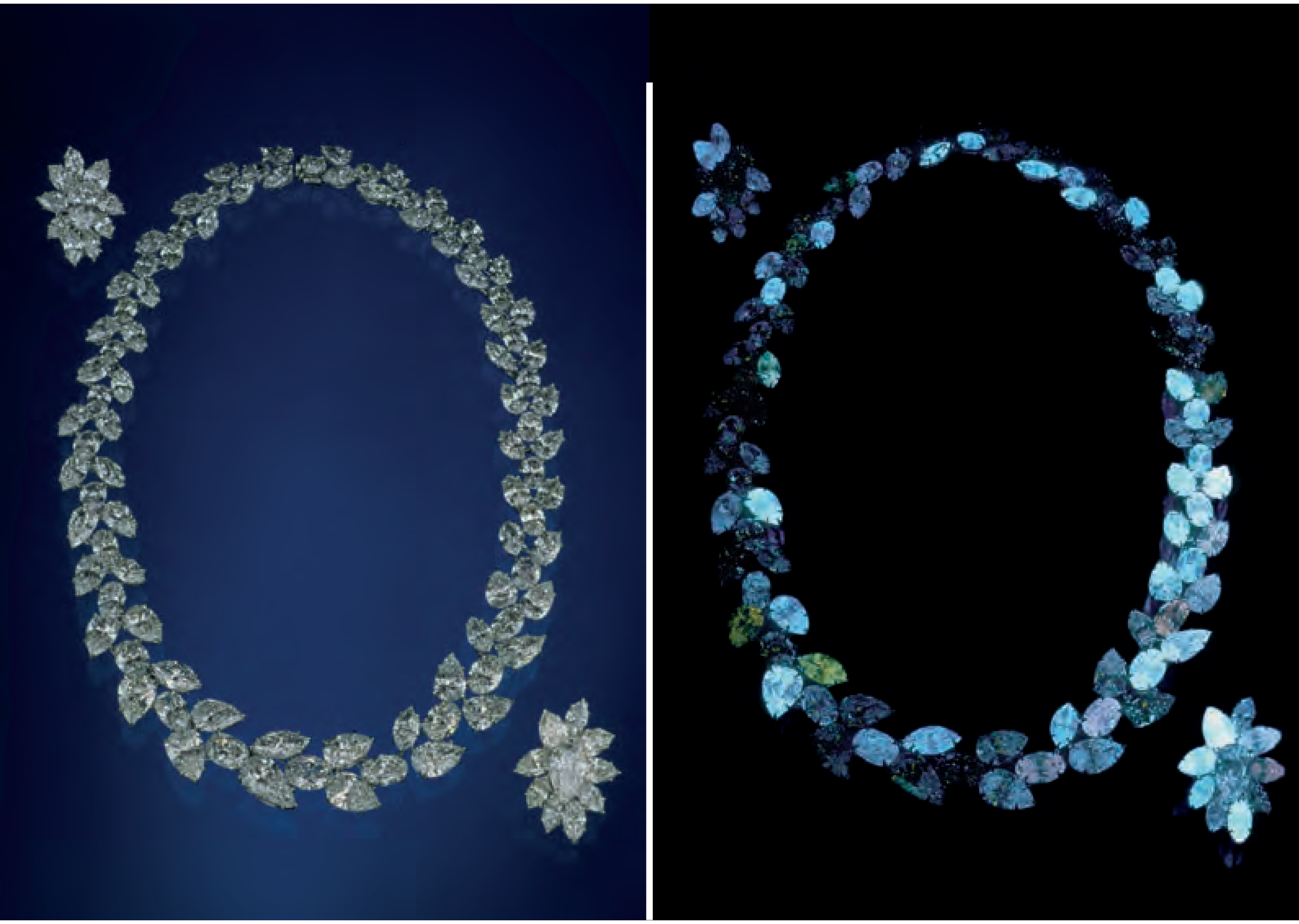


Fig.30: Diamond studded necklace and ear clips in artificial light and long-wave UV light.
Photo source: ©GIA and Harold & Erica Van Pelt

OUR UV AND ANALYSIS LAMPS

UV analysis lamp

- UV analysis lamp
- Short-wave light (wavelength: 254 nm)
- Long-wave light (wavelength: 366 nm)
- Power per illuminant 6 W
- Power supply 240 VAC
- Lamp dimensions (W×D): 145 mm x 35 mm
- Dimensions (W×H×D): 260 mm x 70 mm x 60 mm
- Weight: 1233 g

ORDER NUMBER **UV240**

Stand for UV analysis lamp

- Table stand for UV analysis lamp
- Material: sheet steel with plastic coating
- Foot section dimensions (W×H×D): 100 mm x 205 mm x 190 mm
- Weight: 781 g

ORDER NUMBER **UV241**